Inquiry and Investigation
Lesson Plan

Name: **RevaBeth Russell**
Contact Information: **rrussell@alpine.k12.ut.us**

Course Name: **Biology**
When is the Hamburger Safe to Eat?
Adapted from *Science and our Food Supply* FDA and NSTA publication 2001

Core Curriculum Standard Fulfilled:
Standard I Students will understand that living organisms interact with one another and their environment.

Core Curriculum Objective Fulfilled:
Standard I Objective 2 Explain relationships between matter cycles and organisms.
Standard I Objective 3 Describe how interactions among organisms and their environment help shape ecosystems.

Intended Learning Outcomes (ILOs) Fulfilled:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interest
5. Demonstrate Awareness of Social and Historical Aspects of Science
6. Demonstrate Understanding of the Nature of Science

Science Language Used:
variable, evidence, data, experiment, investigation, technology, compare, population, evidence, quantitiative

Time Needed To Complete Inquiry:
45 minutes to set up, 2 days for incubation (no class time) and **15 minutes for observations and evaluations.**

Inquiry:
This is a Semi-guided Inquiry activity.
Why is it necessary that ground beef be cook thoroughly?

Assessment:

You usually know that the students have succeeded because they want to show you their Petri dishes.
A simple lab write up of procedures, results, and conclusions is used.

Prior Knowledge Needed:
Students need to know how to cook a ground beef patty safely in a frying pan over a hot plate. They need to know how to obtain a meat juice sample from the center of the patty using a Q tip. They need to be able to read a meat thermometer. They need to know how to plate a Petri dish and seal it up.

Students should understand that bacteria is all around us and even in our food. Some bacteria are harmful, some are not. They should know that high temperatures kill bacteria. They should know that because of the nature of ground beef bacteria from the outside of the meat can be mixed up in the center of a patty.
The teacher can review that the temperature reached is the independent variable and the number of bacterial colonies is dependent on the temperature.

Introduction:
***E. coli* outbreaks are common in the news. Death and disabilities have resulted. (Dateline: *When Meat can Kill* (I think that is the title). Salt Lake Tribune http://www.sltrib.com/search/ci_4178494 Aug.14, 2006.)The students will be told that they are owners and are opening up the Fast Fare Burger Feast in town. They want to sell delicious and safe hamburgers. They need to come up with a protocol for their employees to follow so that this restaurant stays in business.**

Materials:
leanest ground beef possible, plastic food service gloves, frying pans, hot plates, meat thermometers, alcohol swabs, Q-tips, aprons, nutrient agar Petri dishes, chopping boards, paper plates, markers, tape, spatula, paper towels

Procedures of the Investigation:
The students, in groups of 4, will cook a ground beef patty or two, to at least 4 various temperatures. At each temperature they choose they will take a juice sample from the middle of the patty and plate it on a nutrient agar dish. These dishes will be labeled, taped up and taped together for incubation of 24 hours at 40^{o} C. or 48 hours room temperature.

The students will then make observations and inferences about the safety of their meat at the different temperatures based on the number of bacterial colonies growing on the Petri dishes.
Color of the meat center should also be observed and recorded.

Data Collection:
Observation and counts of bacteria on the plates. This always works and makes such a wonder visual result.

Data Analysis:
Because the plates are so visual students are able to see that any ground beef cooked at lower than 160o F is unsafe to eat.

Closure:
A good video to watch after is the video When Meat Kills and classroom discussion.